Wetland monitoring for off-site wetland mitigation at the Olentangy River Wetland Research Park for Spring-Sandusky Interchange (Year 2 - 2002)

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Introduction

This report represents the second-year mitigation report for the project "*Wetland Monitoring and Management Plan for Off-Site Wetland Mitigation for Spring-Sandusky Interchange*" contracted between The Ohio State University and the Ohio Department of Transportation. It represents the second-year monitoring of the restoration of a 13-acre bottomland forest, carried out as part of the mitigation for the Spring-Sandusky interchange project in downtown Columbus. The bottomland hardwood forest is part of the 30-acre Olentangy River Wetland Research Park at The Ohio State University (Fig. 1). This report cover the period January 1 - December 31, 2002.

Site Restoration

Restoration/enhancement of this 13-acre bottomland forest involves two major management approaches:

Hydrologic restoration

Four 20 ft wide breeches were made in an artificial levee that runs most of the northern half length of the bottomland forest. The levee had been constructed to prevent floodwater from reaching the floodplain perhaps as long as 100 years ago. In June 2000 and again in April 2001, the levee was breached in 4 locations to allow floodwater to enter the site. Locations of levee cuts are shown in Fig. 2. Restored hydrology is expected to result in increased productivity of canopy trees in the forest in the long term and may result in some species shifts in the short term to more flood-tolerant species. The increased flooding is also expected to bring in nutrients and plant propagules, both of which will lead to enhanced forest productivity and biodiversity.

Removal of alien honeysuckle

Volunteer groups, in collaboration with the ORWRP, ODOT, and the City of Columbus, are removing the alien Amur honeysuckle (*Lonicera maackii* Maxim.) as a second part of the restoration. The removal of honeysuckle is expected to allow the bottomland subcanopy to become more diverse as its dense biomass is removed.

Aerial Photographs for 2002

Aerial photography of the bottomland forest is obtained twice per year by ODOT aircraft (forest with canopy leaves down in winter and peak biomass in August). Photos for January 4, 2002 and August 2, 2002 are shown in Figures 3 and 4 respectively.

The winter photograph of January 4, 2002 (Fig. 3) illustrates the forest floor without canopy vegetation blocking the view. No scours or excessive destabilization of the floodplain is seen as a result of the flooding. The photo also illustrates considerable ponding, as expected, at the northern part of the bottomland hardwood forest and at internal channels in the southern third of the bottomland forest. This corresponds well with the contours measured

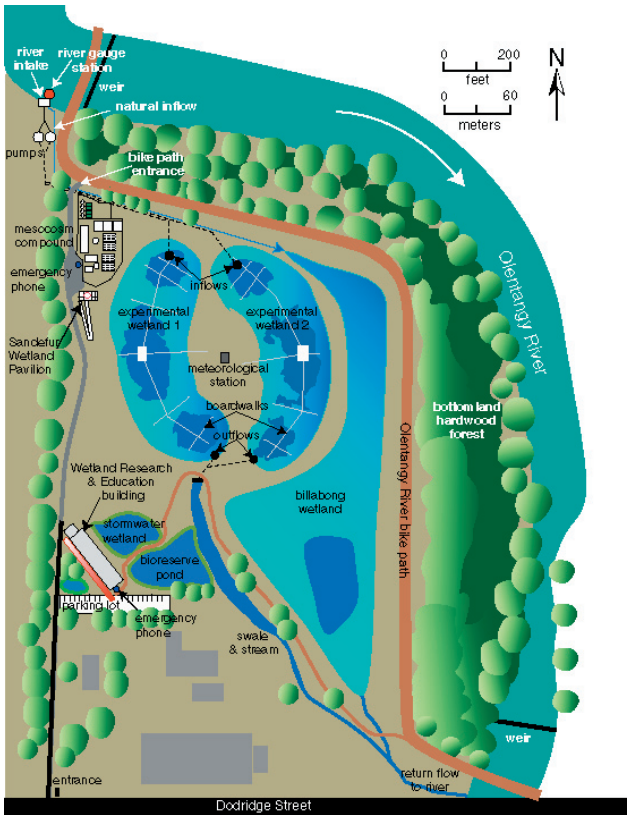

Figure 1. Master map for the Olentangy River Wetland Research Park at The Ohio State University. The bottomland hardwood forest is shown along the northern and eastern edges of the research park.

Figure 2. The 13-acre bottomland forest monitoring area, indicating land elevations, monitoring wells, and 4 locations ("cuts") where artificial levee was breached to allow bottomland flooding.

Table 1. Dates of honeysuckle harvesting in the bottomland hardwood forest at the Olentangy River Wetland Research Park

Date	Group	Location of activity	Herbicide?	Est. man-hrs
September 18, 2001	FLOW/OSU volunteer group	northern one-fifth	yes	100
October 18, 2001	Franklin Heights/FLOW volunteers	northern one-third	no	30
May 3, 2002	OSU/ORWRP Wetland Day	northern one-third	yes	60

Figure 3. Aerial photo of enire site on January 4 2002, about 19 months after levees were cut and 3 months after initial honeysuckle harvesting.

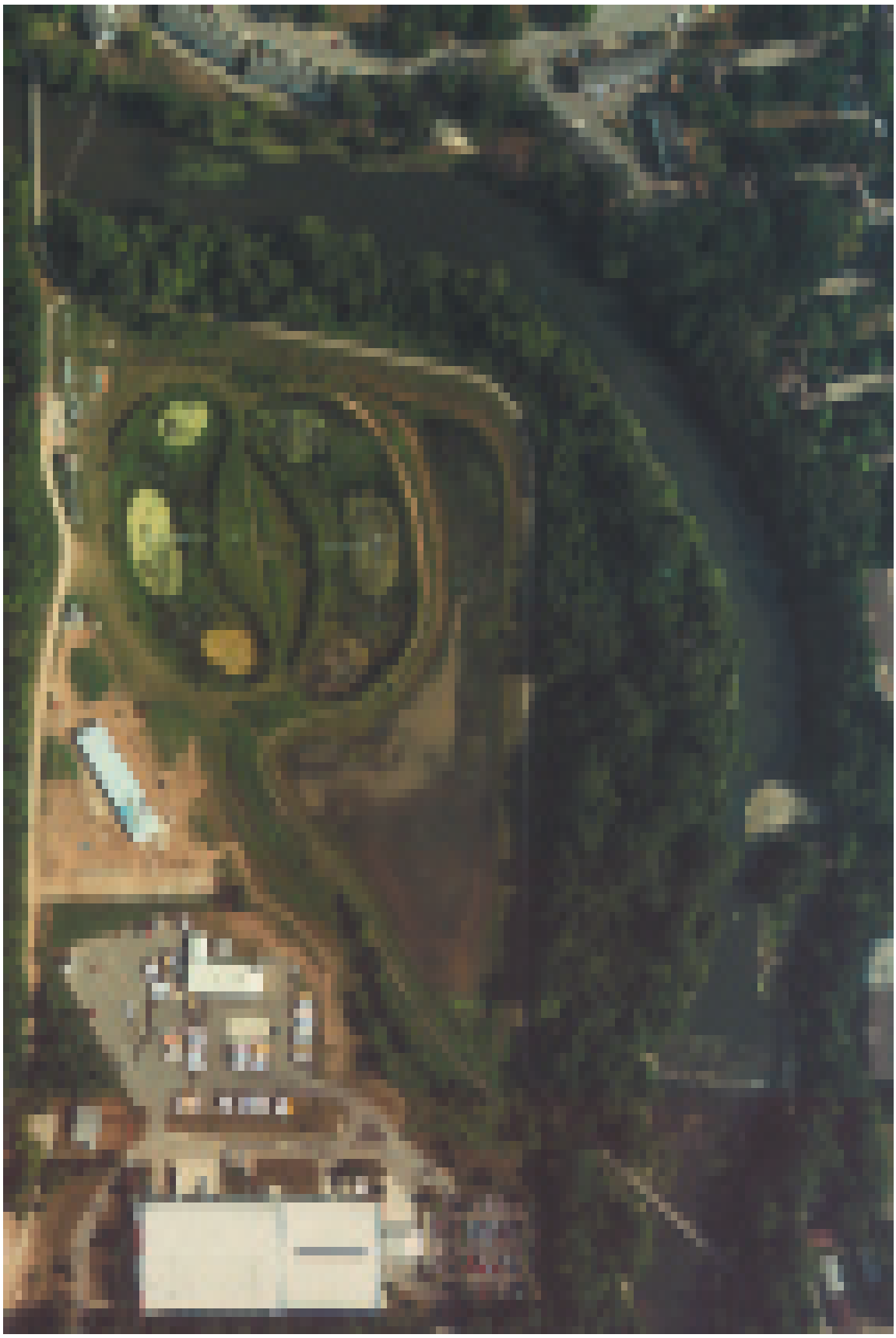

Figure 4. Aerial photo in August 2, 2002, for bottomland forest and Olentangy River Wetland Research Park. This is approximately 26 months after cuts were made in levee. Vegetation shows no permanent scars in forest canopy from the cuts.

before the restoration began as shown in Fig. 2. Groundcover is also seen much more clearly in this photo in the northern third of the bottomland forest, possibly due to extensive honeysuckle removal in that part of the forest in 2001.

The levee cuts shows no obvious effect on canopy structure in the August 2002 photograph (Fig. 4) and the canopy appears to be 100% cover and in good health.

Honeysuckle management in 2002

A summary of alien Amur honeysuckle (*Lonicera maackii* Maxim.) removal events at the bottomland hardwood forest since these efforts began is given in Table 1. There were 2 events in 2002 where volunteers were mobilized to remove the alien species from the forest understory. About 30 volunteers removed honeysuckle aboveground biomass as part of a restoration of portions of northwestern corner of the ORWRP bottomland forest on an event called "Wetland Day" on May 3, 2002 (Fig. 5). The city of Columbus applied herbicides on plant stumps (well away from volunteers) during this event. This event was cosponsored by Friends of Lower Olentangy Watershed (FLOW), Ohio Department of Transportation (ODOT), the City of Columbus, and the Olentangy River Wetland Research Park. A second honeysuckle harvest with about 30 OSU volunteers on September 24, 2002. All harvesting to date has occurred in the northern one-third of the bottomland hardwood forest, approximately to the curve in the river. It is estimated that about 4 acres of the bottomland forest have had a first or second honeysuckle harvesting to date.

Figure 5. Photos taken on May 3, 2002, showing removal of alien honeysuckle plant material from bottomland hardwood forest by Ohio State University volunteers during ORWRP "Wetland Day."

Table 2. Floods of bottomland hardwood forest since beginning of the mitigation monitoring of this bottomland hardwood forest in January 2001.

Date	Peak river stage, ft
April 11, 2001	16.15
December 2, 2001	16.74
December 18, 2001	17.87
February 3, 2002	16.91
April 5, 2002	16.88
April 14-18, 2002	17.88

A study in October 2002 (described below) suggests that significant honeysuckle regeneration occurred in the cleared area from cut stumps in the 2002 growing season.

Hydrology

A stream gauging station with an Ott Thalimedes data logger and water quality probe was installed on the Olentangy River in June 2001 and a 30-min interval reading was established for downloading data (see "Clinton Park weir gage station in Fig. 2). Two water level stations with Ott Thalimedes data loggers were installed at upstream and downstream sites in the bottomland forest in December 2000 (see "Ott monitoring wells" in Fig. 2) with 30-min interval readings. Recording started February 2001. One Ott recorder is located near the 1st cut in the levee and is referred to as "upstream" site. The 2nd Ott is located downstream of the 4th and last cut and is referred to as the "downstream" site.

A summary of all flooding events that have occurred since this monitoring began in January 2001 is given in Table 2. Four major flooding events occurred into the bottomland hardwood forest in the spring 2002 with sufficient stage to flood the bottomland forest through the cut notches (Table2; Fig. 6). Water level records for periods of available data from the upstream groundwater recorder in the bottomland forest is shown in Figure 7. In all cases, substantial flooding of Olentangy River water occurred in the bottomland forest as a result of the cut notches. Peaks in Fig. 7 appear to be truncated because of instrument error but otherwise indicate the rapid increase in water level that occurs in the floodplain during flooding. The monitor also indicates several periods of increased water level associated with increases in river state that did not result in overbank flooding.

Figures 8 and 9 shows photos from one of the large flooding event to occur on the Olentangy River since 1995: April 14, 2002.

Water Quality

Figure 10 and 11 show river stage and water quality in the Olentangy River during several flooding events in 2002. Flooding usually causes increased pulsing in turbidity (February, April and May) and often causes decreased dissolved materials (see conductivity in May 2002 flood in Fig. 11). Increases in turbidity that occur at the same time as the flooding of the bottomland means that a significant load of sediments is being delivered to the bottomland forest with each flood event. These sediments are bringing in substantial amounts of nutrients, particularly phosphorus.

Vegetation

Canopy

Forest canopy vegetation was not monitored by formal

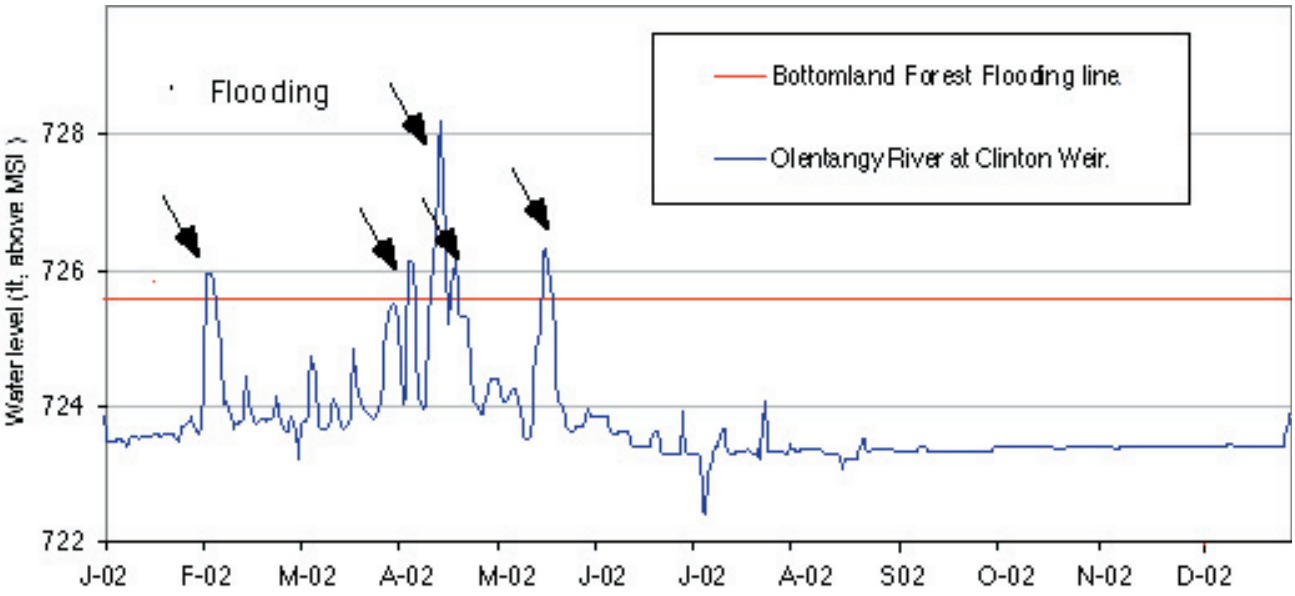

Figure 6. Hydroperiod for Olentangy River at ORWRP for 2002. Arrows indicate 5 flood peaks (4 independent floods) that occurred in 2002 in the bottomland hardwood forest. Flooding line indicates approximate level at which river stage floods bottomland.

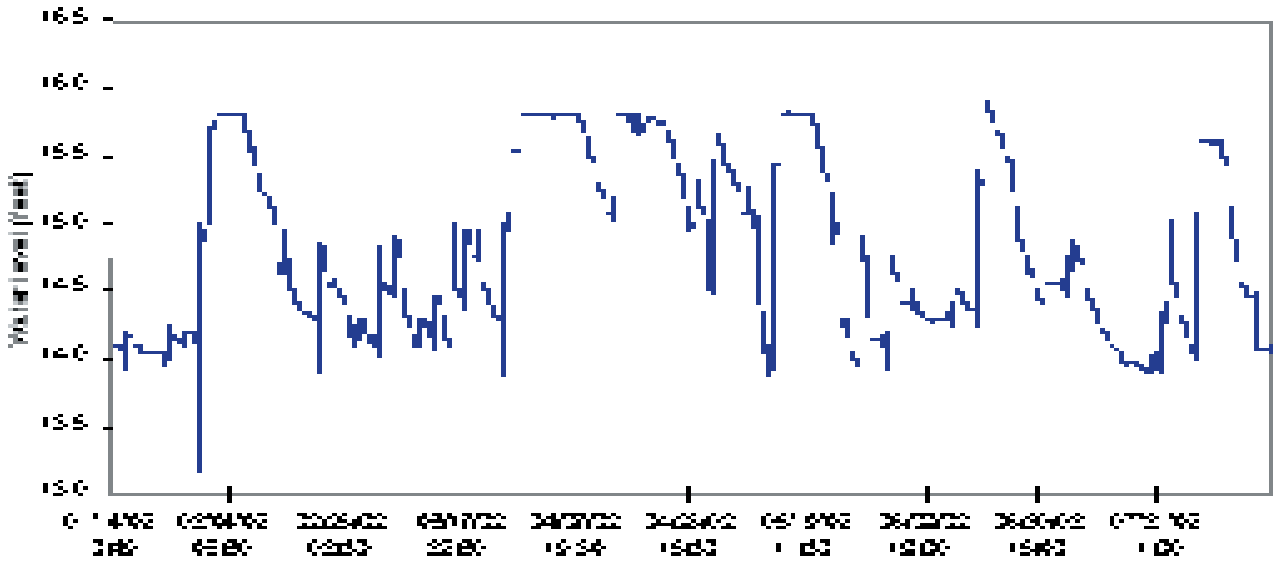

Figure 7. Upstream groundwater monitoring well in bottomland hardwood forest, January-July, 2002. Water level compares to water level in river staff gage.

Figure 8. Olentangy River flood of April 14, 2002 flood as viewed from northern bikepath bridge. Bottomland forest is on right during flooding. Note river staff gage almost completely submerged in lower right of photo.

Figure 9. Flooding event in April 14, 2002. Top: cut #1 in the bottomland forest levee with water flowing from the river on left into the bottomland forest. Bottom: Interpretative sign and bikepath under water near Cut #1.

survey in 2002 as the survey in 2001 still reflects canopy vegetation and no changes have been observed. Tree species with the highest relative densities were box elder (*Acer negundo*), Ohio buckeye (*Aesculus glabra*) and Eastern cottonwood (*Populus deltoides*). Most of the tree species (12 out of 16) are facultative (FAC) and drier. We continue to believe that in the long run (>50 years) the canopy will change to reflect wetter conditions as a result of the hydrologic restoration. Aerial photography from August 2002 (Fig. 4) show a healthy canopy with no canopy gaps and essentially 100% cover.

Understory

In October 2002, a detailed study was undertaken to determine the effects of Amur honeysuckle (*Lonicera maackii*) harvesting on understory vegetation and soil moisture. (See attached study "The effects of the invasive shrub *Lonicera maacki* on species richness and soil moisture in the bottomland hardwood forest at the ORWRP"). Twenty 2 m x 2 m sample plots were established in the bottomland hardwood forest. Ten plots were located in a section of the forest where *L. maackii* had recently been removed, and ten

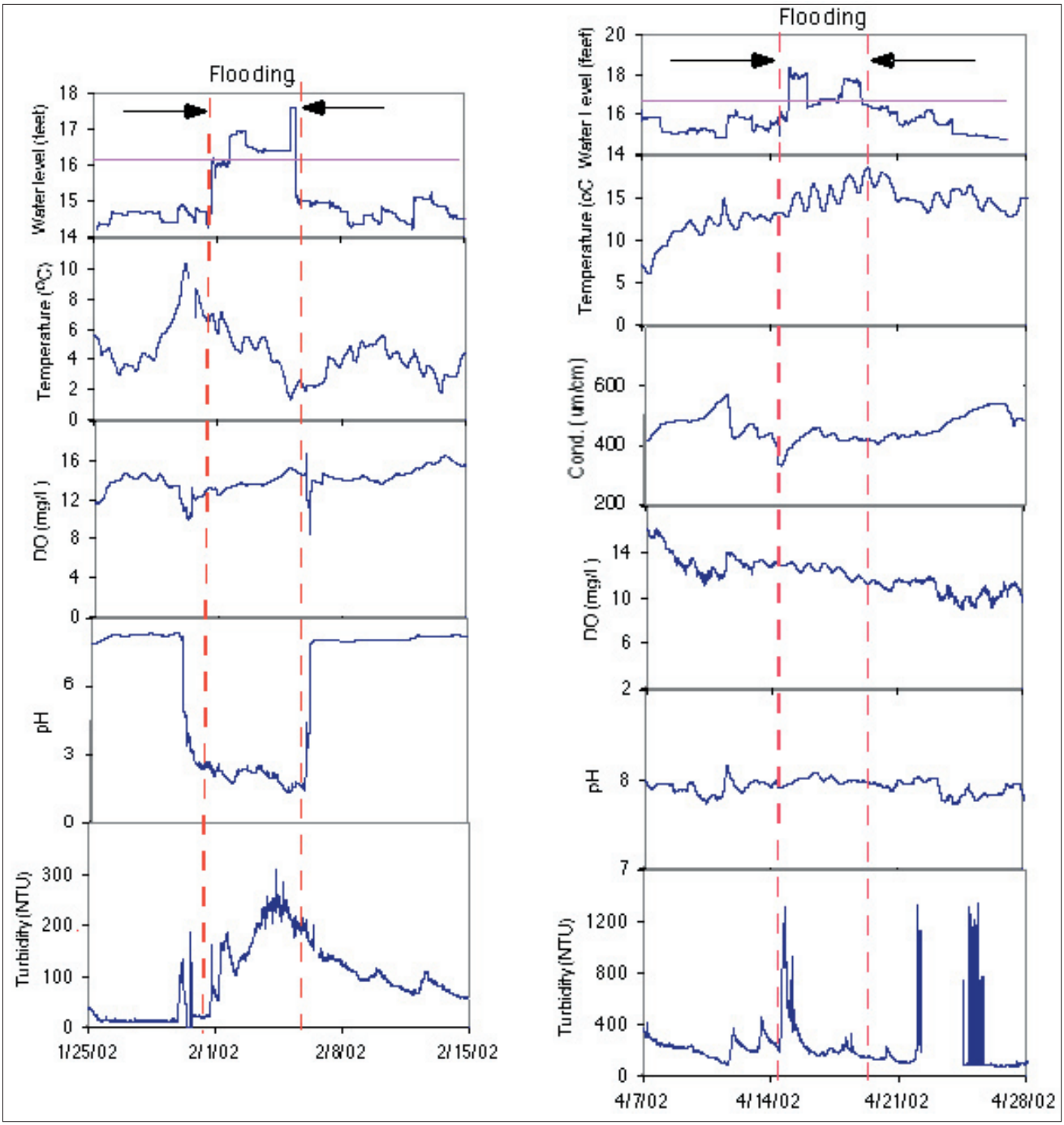

Figure 10. River stage and water quality of Olentangy River before, during, and after bottomland flooding of February and mid-April 2002.

were located in an area where *L. maackii* has not been cleared. Overall understory species richness was higher in cleared areas (25) than in uncleared areas (14) (Table 3). Species richness was higher in the cleared area of the forest for understory woody plants, herbs, vines, and trees. There was no correlation between soil moisture and species richness, nor was there a correlation between soil moisture and the number of *L. maackii* individuals present per plot.

Most significant are the results showing that cleared areas have greater woody understory species richness. But the study also observed that *L. maackii* abundance was slightly higher in cleared areas than in uncleared areas (Table 3). This suggests that continued and even more aggressive *L. maackii* removal will be necessary to ensure a diverse understory community in the bottomland hardwood forest.

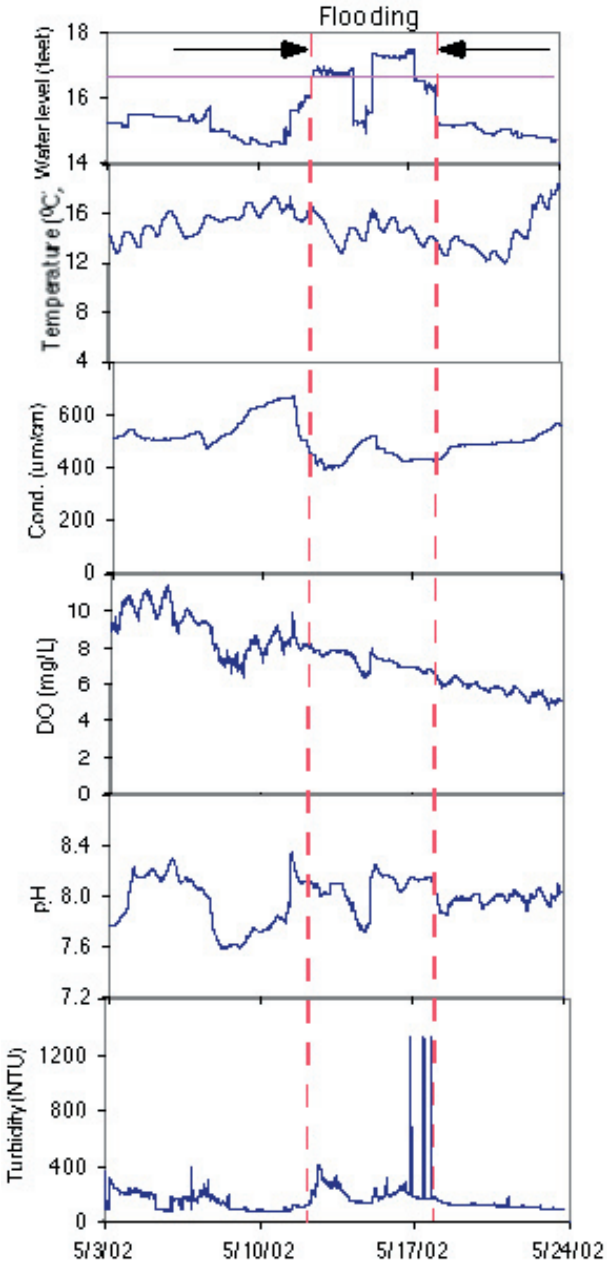

Figure 11. River stage and water quality of Olentangy River before, during, and after bottomland flooding of May 2002.

Table 3. Understory plant species in cleared and uncleared areas of bottomland forest in October 2002 (UNK indicates unknown species).

Species	Cleared plots	Uncleared plots
Woody Understory Plants		
Amur Honeysuckle	28	25
Box elder	2	0
Paw paw	9	0
UNK F (laurel)	1	0
UNK J	1	0
UNK M	1	0
UNK N	19	0
UNK O	1	0
UNK P	2	0
UNK R	11	0
UNK X	0	1
TOTAL WOODY INDIVIDUALS	75	26
TOTAL WOODY TAXA	10	2
Herbs		
Canada goldenrod	4	5
Fall phlox	0	28
Grasses	8	4
Ground Ivy	11	18
Long Bristled Smartweed	6	0
Tall Larkspur	0	5
UNK B	21	10
UNK C	1	0
UNK E (ginger)	3	53
UNK H (aster)	31	0
UNK I (Ranunculus)	81	37
UNK Q (bittercress)	7	0
UNK S	1	0
UNK U	0	15
UNK W (violet)	0	13
Wild Carrot	3	0
TOTAL HERB INDIVIDUALS	177	188
TOTAL HERB TAXA	12	10
Vines		
Bristly Greenbriar	2	1
Grape	3	2
Poison ivy	1	0
TOTAL VINE INDIVIDUALS	6	3
TOTAL VINE TAXA	3	2